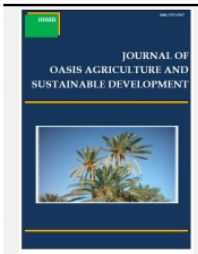

JOURNAL OF OASIS AGRICULTURE AND SUSTAINABLE DEVELOPMENT

www.joasdjournal.org

JOASD

p-ISSN: 2724 – 699X
e-ISSN: 2724-7007

Agricultural valorization of sewage sludge: Impacts on soil bio-physico-chemical quality and Triticale (X *Triticosecale wittmack*) production

Wafa Hassen[1], Bilel Hassen[2], Yassine Hidri[3] & Abdenaceur Hassen[1]*

[1] *Water Research and Technology Center (C.E.R.T. E), Borj-Cédria Technology Park, Soliman, Tunisia.*
[2] *Group of Aquatic Bacteriology and Biotechnology (GAB2), LR16INSTM05, The National Institute of Science and Technology of the Sea, University of Carthage, 2025 Salammbô, Tunisia.*
[3] *Laboratory of Integrated Olive Production (LR16IO3), Sousse, Tunisia.*

Article info

Article history:
Received: 27 August 2024
Accepted: 10 November 2024

Keywords: Sewage sludge, soil characteristics, fertilizing elements, trace elements, Triticale crop yield.

***Corresponding author**
abdohas@gmail.com

Conflict of Interest: The authors declare no conflict of interest.

Abstract

The current investigation aimed to assess the impact of sewage sludge on the physico-chemical and bacteriological characteristics of soils cultivated with the forage Triticale "X *Triticosecale Wittmack*." The sewage sludge was sourced from the activated sludge treatment plant in the city of Béja, in northern Tunisia. These effects were compared with those of the unaltered control plot and the plot treated with chemically fertilized ammonitrates. The findings indicated an enhancement in soil organic content (TOC and organic matter) and a notable increase (S-N-K for p = 0.05) in fertilizing elements (N, P, and K) and trace elements (Fe, Cu, Zn, and Mn). Some observed this increase depended on the quantity of sludge added. These outcomes were consistent across both soil horizons examined (0–20 and 20–40 cm). Nevertheless, this practice resulted in a marked rise in soil salinity and contamination by Cd and Pb. The accumulation of Pb in the soil was noticeable with increasing sludge doses of 6, 12 and 18 t/ha, exceeding levels surpassing the maximum allowable concentration outlined in the NFU 44-041 standard. The findings revealed that the sewage sludge obtained from Béja contained significant fecal indicator bacteria, particularly fecal coliforms and fecal streptococci (values) as well as enteric pathogens like *Salmonella spp*. and *Pseudomonas aeruginosa*. The high nutrient content of the sewage sludge also provided an ideal environment for the growth of these microorganisms. Additionally, an increase in the quantity of sewage sludge (6, 12, and 18 t/ha) resulted in the accumulation of Pb in the soil, surpassing the maximum allowable concentration (MAC) specified in the NFU 44-041 standard. Therefore, it is crucial to enhance and restore the bacteriological quality of the sewage sludge from Béja through natural air-drying or thermal drying before its reuse in agriculture and application on agricultural soils.

1. INTRODUCTION

Water used by individuals in households or industries will inevitably result in the generation of waste. This wastewater is collected in the sewer system and transported to wastewater treatment plants for purification before being discharged back into the natural environment. Within the sewage treatment facility, the wastewater undergoes various treatment processes (I Aire, II Aire, and III Aire), during which clean water is separated from a residual by-product known as sludge. This by-product is formed due to the biological activity of microorganisms present in sewage treatment plants, which break down non-degradable oxidizable substances in the wastewater for removal. The increasing number of wastewater treatment plants globally results in the production of substantial quantities of sewage sludge, which serves as an organic and mineral additive containing high levels of organic matter, nitrogen, phosphorus, and trace elements (Hechemi et al., 2020a and b, 2021; Hamdi et al., 2019). These sewage sludges also contain elevated levels of pollutants such as ETM, microorganisms, certain pathogens, and more.